

## REMARKS

This application has been reviewed in light of the Non-Final Office Action mailed January 25, 2008. Claims 1-5 are now pending in the application. The specification has been amended for further language clarification. Claims 1, 4 and 5 have been amended. No new matter has been added. The Examiner's reconsideration of the rejections in view of the following remarks is respectfully requested.

## SPECIFICATION

The disclosure was objected to due to informalities. Applicant has amended the specification accordingly to further clarify the terms "molar proportion" and "percent by weight" as discussed in the disclosure. These amendments do not go beyond the scope of the disclosure of the original description, as one skilled in the technology would automatically read the phrase in this way.

Namely, while the terms "molar proportion" and "percent by weight" may indeed constitute two different *values*, they have a direct relation to each other with respect to the total mixture. To illustrate, please note that one can calculate the molar proportion of each oxide constituent in a composition by dividing the value of the weight % of each oxide by the formula weight (i.e., atomic weight) of each oxide.

By way of example, Applicant encloses herewith a sample exercise sheet for calculating mineral formulas (*See Exhibit A: "The Solid Earth/Mineralogy; Dr. Jeff Ryan: Official Class Syllabus 1999, Exercise Menu for Class*). As can be seen in the enclosed Mineralogy Exercise 1, Step 1 involves calculating the molar proportion of each oxide in a mineral composition, given the %wt. of each oxide in the composition.

In addition, Applicant encloses herewith Exhibit B, which illustrates examples of

recalculation of chemical analysis from weight % oxides data (see Table 2: ‘Recalculation of a Gypsum Analysis’). Reading Table 2, it can be seen that the molecular proportion of CaO is about 32.44% by weight, the molecular proportion of SO<sub>3</sub> is about 46.61% by weight, and the molecular proportion of H<sub>2</sub>O is about 20.74% by weight.

By way of further explanation, please note that the term “molar proportion” can be used interchangeably with “molecular proportion” in the art. To illustrate using the above example in Exhibit B, ‘molecular proportion’ may be defined as the number of moles of each oxide in a given amount of the mineral.

Accordingly, one of ordinary skill in the art would properly interpret what is discussed in the disclosure. Nevertheless, Applicant has amended the specification for sake of further clarity, and withdrawal of the objection is respectfully requested.

### **CLAIM OBJECTIONS**

Claim 1 has been amended to correct the antecedent basis for the phrase “as the electron emitter substance.” Withdrawal of the objection is respectfully requested.

### **§112 REJECTION**

Claims 1-5 were rejected under 35 U.S.C. §112, first and second paragraphs, as failing to comply with the enablement requirement and being indefinite. Applicant has amended claim 1 in accordance with the above specification amendments for further clarification, and respectfully refers to the above explanation of the terms “molar proportion” and “percent by weight.” One of ordinary skill would automatically interpret the claims clearly, and thus, no new matter has been added. Applicant notes that the terms as used in the present claims are used to define a specific mixing ratio for a mixture of oxides, wherein such ratio is described in terms of **molecular**

**proportions of each oxide in the mixture.** The molar or molecular proportion is generally defined as the number of moles of each oxide in a given amount of the *total* mixture.

It is respectfully asserted that one of ordinary skill in the art would be familiar with the concepts of molarity and percent by weight, would be able to calculate and determine the desired ratio of oxides in the claimed mixture, and would clearly interpret and understand the claims to read as such as originally presented. Nevertheless, claim 1 was amended to further clarify the language.

Claims 4-5 were amended to delete the term "a use of" and have been revised to further clarify the electron emitter substance according to claim 1.

Claims 2-3 depend from and include all the limitations of claim 1.

Accordingly, withdrawal of all the §112 rejections is respectfully requested.

#### **§101 REJECTION**

By the Office Action, claims 4-5 were rejected under 35 U.S.C. §101 as being directed to non-statutory subject matter. As shown above, claims 4-5 have now been amended to delete the term "a use of" and further clarify the electron emitter substance. Withdrawal of the 101 rejection is respectfully requested.

### **CONCLUSION**

In view of the foregoing amendments and remarks, Applicant respectfully requests that the rejections of the claims set forth in the Non Final Office Action of January 25, 2008 be withdrawn, that pending Claims 1-5 be allowed, and that the case proceed to early issuance of Letters Patent in due course.

It is believed that no additional fees or charges are currently due. No additional charges are authorized.

Respectfully submitted,

Dated: \_\_\_\_\_

By: \_\_\_\_\_

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Dated: April 21, 2008

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## Exhibit A (4 pgs)

# GLY 3315\*/3200: The Solid Earth\*/Mineralogy

[\*as of Fall, 2000!]

4 credit hours

Instructor: Dr. Jeff Ryan

Office: SCA 507

Labs: SCA 508, SCA 117, CHE 323

Email: [ryan@chuma.cas.usf.edu](mailto:ryan@chuma.cas.usf.edu)

Meeting times: T-R, 12:00 to 3:20 PM

Meeting Place: CHE 325.

Please note that in this class, lab and lecture are not treated as separate entities, as they were in your introductory courses. Activities and class lectures will be interwoven (with reasonably generous breaks!) in both sessions each week. It is thus critically important that you make a point of attending each class session! Also, we WILL be using the Internet as part of this course, both for additional text materials, and for homework exercises, so you will need to set up a USF computer account! See me about this if you have questions.

[Link to Official Class Syllabus for GLY 3200, Fall 1999](#)

### Required Textbooks

Perkins -- *Mineralogy*

MacKenzie and Adams -- *A Color Atlas of Rocks and Minerals in Thin Section*

## Exercises Menu for Class

Note: Due dates for exercises will be assigned IN CLASS!

Exhibit A

Pj. 2

Exercise 1: Calculating Mineral Formulas

Exercise 2: Trace constituents in Minerals and "Onuma" plots

Exercise 3: Symmetry in our Lives.

Exercise 4: Unit Cells and Lattices



[Link back to Solid Earth homepage](#)

**Mineralogy Exercise 1: Calculating Mineral Formulas****Exhibit A pg. 3**

The chemical compositions of minerals as reported in their chemical formulas are really Ideal compositions, based only on the proportions of their Major Element constituents. [Major elements are defined as any element occurring at >1% wt. in a mineral, and/or any element which predominantly fills a structural site in a mineral]. In the real world, however, minerals include both Minor Elements (1.0 - 0.1% wt. abundance) and Trace Elements (>0.1% wt in abundance) in their structures, and often it is very useful to know how these other elements are distributed in the mineral structure. Unfortunately, when mineral compositions are analyzed chemically and reported, the values are traditionally reported in wt.% oxides and in ppm (parts per million, =  $\mu\text{g/g}$ ; 10,000 ppm = 1% wt.), which isn't very enlightening as to mineral structure.

However, if we know a little bit about element valences, and the atomic structures of minerals (ala Pauling's Rules), we can calculate their formulas from wt % data. Box 1.4 in Perkins (on page 22) goes over how we do this. Below is a simplified "cookbook" for getting mineral formulas from wt% data.

- 1) Divide each oxide constituent by the formula weight of the oxide. This gives you the **Molar Proportions of each oxide**.
- 2) Multiply the molar proportions of each oxide by the number of cations in the oxide. This gives you the **molar proportions of cations** in your mineral.
- 3) Multiply the molar proportions of each oxide by the number of oxygens in each. This gives you the **molar proportions of Oxygen** in your mineral.
- 4) Sum the **Molar proportions of Oxygen**, and divide this sum by the number of oxygens in the mineral's ideal chemical formula (i.e., 4 oxygens for olivine; 8 oxygens for feldspar). The value you get is a **Correction factor** (in Perkins, a "fudge factor") that will allow you to obtain formula units.
- 5) Now, divide the **Molar Proportions of each Cation** by the **Correction Factor**. This will give you the **proportions of each cation with respect to oxygen** (or the "Oxygen units" of each cation) in your mineral. At this point, one can group your cations by valence and calculate the **REAL** mineral formula.

**A) Here** are some mineral compositions in wt.% oxides. What I want you to do is use the cookbook above to generate their mineral formulas.

Oxide, %wt.	Olivine (4 oxygens)	Pyroxene (6 Oxygens)	K - Feldspar (8 Oxygens)	Magnesite (6 oxygens)	Kyanite (20 oxygens)
SiO <sub>2</sub>	40.65	52.70	64.28	--	37.46
TiO <sub>2</sub>	--	0.34	--	--	0.03
Al <sub>2</sub> O <sub>3</sub>	---	1.84	19.19	--	61.52
Cr <sub>2</sub> O <sub>3</sub>	.007	--	--	--	0.08
Fe <sub>2</sub> O <sub>3</sub>	--	2.12	0.09	--	0.71
FeO	10.56	5.42	--	0.56	--
MgO	48.62	15.15	0.10	46.62	0.03

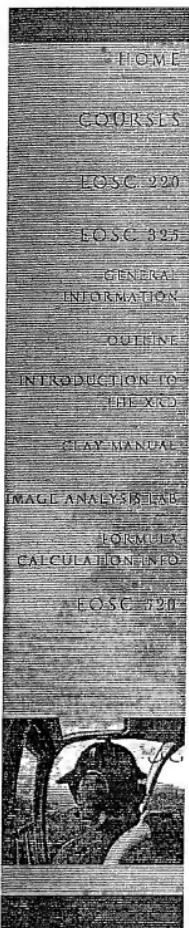
MnO	0.115	0.16	--	0.12	0.006
NiO	.297	---	---	---	---
BaO	---	---	0.11	0.06	---
CaO	0.019	21.58	0.11	0.43	0.02
K <sub>2</sub> O	---	0.01	15.3	---	0.01
Na <sub>2</sub> O	---	0.49	0.92	---	0.03
CO <sub>2</sub>	---	---	---	51.93	---

[Link back to Exercises Homepage](#)

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*Exhibit A*

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COURSES  
EOSC 325

COURSES

**EXHIBIT B**

(2 pgs)

**Formula Calculation**

To download this document in Word format, click here.

In this lab you will learn how to calculate chemical analyses of minerals, both by hand and using the computer program FORMULA (supplied). In both cases you will need to have some understanding of the crystal structure of the minerals concerned.

The quantitative analyses of minerals are generally presented as weight% metals (for minerals without oxygen such as sulphides) or weight% oxides (e.g. for sulphates, phosphates, and silicates). In order to determine such things as the mineral formula and end member content (for minerals exhibiting solid solution chemistry), the atomic proportions must be determined. This requires a series of calculations which will be described in the following section.

**RECALCULATION OF CHEMICAL ANALYSES**

**From weight% metals data**

The recalculation of minerals without oxygen is fairly simple. Data is given as weight% metals as shown in column 1 of Table 1. To determine the atomic proportions (column 3) you must determine how many moles of each element are represented by the weight% values. In effect you assume a weight for the mineral (and therefore elements) and you divide these values by the appropriate atomic weight (column 2). To determine the formula of the mineral you must then determine atomic ratios (column 4). Finally, some minerals contain sites that can be occupied by more than one element. In mineral formulas this is often represented by elements separated by commas and in brackets (e.g. sphalerite:  $(\text{Zn}, \text{Fe})\text{S}$ ). The distribution of elements in these sites is sometimes given more specifically (e.g.  $(\text{Zn}_{99.7}\text{Fe}_{0.3})\text{S}$ ). The subscripts represent the relative atomic percent. To determine this the atomic proportion values (column 3) of concern are normalized (column 5).

Table 1: Recalculation of a Sphalerite Analysis (after Hurlbut and Klein, 1985).

	1 weight%	2 atomic weights	3 atomic proportions	4 atomic ratios	5 Fe:Cd:Zn (x/1.032, %)
Fe	7.99	55.847	0.143		13.8
Cd	1.23	54.938	0.011	1.032	1.1
Zn	57.38	63.390	0.878		85.1
S	32.99	32.066	1.029	1.029	
Total	99.59				

$(\text{Fe} + \text{Cd} + \text{Zn}): \text{S} \approx 1:1$ , formula is  $(\text{Zn}_{85.1}\text{Fe}_{13.8}\text{Cd}_{1.1})\text{S}$

Note that due to slight errors in the analytical procedure weight% totals may vary a little from the expected 100%.

**From weight% oxides data**

The recalculation of minerals containing oxygen are a bit more complicated because the chemical analyses are given in weight% oxides. For non-silicates such as sulphates and phosphates the formula can sometimes be determined simply by calculating molecular proportions, that is the number of moles of each

oxide in a given amount (in grams) of the mineral. The calculations are very similar to those described above, except that the atomic weight of the oxides (not individual elements) are used. As an example, Table 2 illustrates the recalculation of a gypsum analysis.

Table 2: Recalculation of a Gypsum Analysis (after Hurlbut and Klein, 1985).

	1 weight%	2 molecular weight	3 molecular proportion	4 molecular ratios (approximate)
CaO	32.44	56.08	0.57846	1
SO <sub>3</sub>	46.61	80.08	0.58211	1
H <sub>2</sub> O	20.74	18.00	1.15222	2
Total	99.79			



For silicate minerals the calculations must go further. They follow the steps above until the calculation of molecular ratios (column 4). At this point the cations are separated from the oxygen. The "proportions of cations" values are the same as or some multiple of the molecular proportion depending on the atomic ratios in the oxides. For instance, for SiO<sub>2</sub> the proportions would be the same since there is one mole of Si in one mole of SiO<sub>2</sub>. However, for Al<sub>2</sub>O<sub>3</sub> the cation proportion would be two times the molecular proportion since there are two moles of Al for every mole of Al<sub>2</sub>O<sub>3</sub>. Similarly, the amount of oxygen in each oxide is some multiple of the molecular proportion.

The cation proportions are then recalculated based on the number of oxygens (and OH) in hydrous silicate minerals) expected in a formula unit (usually based on crystal structure information). To calculate these values you must determine the total number of oxygens associated with the cations. You then divide each of the cation proportion values by this number (you now have the number of cations per one oxygen) and multiply by the number of oxygens in the formula unit. The number of oxygens in a formula unit divided by the total oxygens is referred to as the oxygen factor. Any atomic ratios can now be determined.

As an example Table 3 illustrates the recalculation of an amphibole analysis. Note that the amphibole analysis contains data for H<sub>2</sub>O which is interpreted to be (OH) groups in the amphibole structure.

Table 3: Recalculation of an Amphibole Analysis (after Hurlbut and Klein).

	1 weight%	2 molecular weight	3 molecular proportion	4 number of cations	5 total (O OH)	6 cations based on 24 (O, OH)	7 based on 23 (O)
SiO <sub>2</sub>	56.16	60.073	0.9346	0.9346	1.8692	7.926	7.931
Al <sub>2</sub> O <sub>3</sub>	0.20	101.945	0.0019	0.0038	0.0057	0.032	0.032
Fe <sub>2</sub> O <sub>3</sub>	1.81	159.676	0.0113	0.0226	0.0339	0.192	0.192
FeO	6.32	71.841	0.0880	0.0880	0.0880	0.746	0.747
MgO	19.84	40.299	0.4921	0.4921	0.4921	4.173	4.176
MnO	2.30	70.932	0.0324	0.0324	0.324	0.275	0.275
CaO	9.34	56.072	0.1665	0.1665	0.1665	1.412	1.413
Na <sub>2</sub> O	1.30	61.974	0.0210	0.0420	0.0210	0.356	0.356
K <sub>2</sub> O	0.14	94.191	0.0015	0.0030	0.0015	0.025	0.025
H <sub>2</sub> O	2.16	18.010	0.1198	0.2396	0.1198	2.032	
Total	99.57				2.8301		

*Exhibit  
B  
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